

AMENDMENTS TO THE SPECIFICATION:

Page 1, please add the following new paragraphs before paragraph [0001]:

[0000.2] CROSS-REFERENCE TO RELATED APPLICATIONS

[0000.4] This application is a 35 USC 371 application of PCT/DE 03/03314
filed on October 7, 2003

[0000.6] BACKGROUND OF THE INVENTION

Please replace paragraph [0001] with the following amended paragraph:

[0001] **Technical** Field of the Invention

Please replace paragraph [0002] with the following amended paragraph:

[0002] Both pressure-controlled and stroke-controlled injection systems can be used to deliver fuel into combustion chambers of autoignition internal combustion engines. Injection systems with high-pressure reservoirs have the advantage that the injection pressure can be adapted to the load and speed of the engine. A high injection pressure is required in order to reduce emissions produced and to achieve a high specific output of the engine. Since the pressure level that high-pressure fuel pumps can achieve in the high-pressure reservoir is limited for strength reasons, a pressure booster at the fuel injector can be used to boost pressure further in fuel injection devices with a high-pressure reservoir.

Page 2, please replace paragraph [0005] with the following amended paragraph:

[0005] DE 102 18 904.8 relates to a fuel injection device. ~~This proposed version of a fuel injection device~~ for internal combustion engines having ~~has~~ a fuel injector ~~injector~~, which can be supplied from a high-pressure fuel source, and ~~has~~ a pressure-boosting unit. The closing piston of the fuel injector protrudes into a closing pressure chamber so that the closing piston can be subjected to fuel pressure in order to produce a force that acts on the

closing piston in the closing direction; the closing pressure chamber and the return chamber of the pressure boosting unit are constituted by a shared closing pressure/return chamber. All of the partial regions of the closing pressure/return chamber are permanently connected to one another to permit the exchange of fuel. The pressure boosters known from DE 199 10 970 A1 and DE 102 18 904.8 are actuated by means of an exertion of pressure on or relief of pressure in a return chamber of the pressure booster. Controlling a pressure booster via the return chamber is advantageous in terms of discharge losses and permits a simple triggering of the pressure booster by means a 2/2-way valve.

Page 3, please insert the following new paragraph after paragraph [0007]:

[0007] SUMMARY OF THE INVENTION ~~Depiction of the Invention~~

Page 5, please replace paragraph [0013] with the following amended paragraph:

[0013] BRIEF DESCRIPTION OF THE DRAWINGS ~~Drawings~~

Please replace paragraph [0014] with the following amended paragraph:

[0014] The invention will be explained in detail below in conjunction with the drawings, in which: ~~drawings:~~

Page 6, please replace paragraph [0019] with the following amended paragraph:

[0019] DESCRIPTION OF THE PREFERRED EMBODIMENTS

~~Exemplary Embodiments~~

Page 8, please replace paragraph [0024] with the following amended paragraph:

[0024] The exertion of pressure on the control chamber 20 in order to actuate the injection valve element 24, which is embodied for example in the form of a nozzle needle, occurs via a

line that contains an inlet throttle 21 and connects the ~~nozzle~~ control chamber 20 to the high-pressure chamber 19 of the pressure booster 11. The control chamber 20 contains a nozzle spring 27, which encompasses a pin 28 of the injection valve element and rests against an annular surface of the injection valve element 24. A discharge line 29 that contains an outlet throttle 30 extends between the differential pressure chamber 17 of the pressure booster 11 and the control chamber 20.

Page 11, please replace paragraph [0030] with the following amended paragraph:

[0030] In the embodiment variant of the concept underlying the invention shown in Fig. 1, the piston extension 34 is disposed at the first end 15 of the pressure booster piston 11. When the pressure booster 11 is triggered, a fuel volume flows either out of the differential pressure chamber 17 or into it through this piston extension 34. In this embodiment variant, the recess 35 inside the first housing part 8 is sealed by the first sealing sleeve 36 that is guided in a moving fashion on the piston extension 34. In a manner that is particularly easy to manufacture from a production engineering standpoint, this sealing sleeve can be provided with a flat seat, which can effectively seal the high-pressure-tight connection 33 between the working chamber 12 and the recess 35 in the first housing part 8 into which the conduit 40 that constitutes the central control line 31 feeds. The first sealing sleeve 36, which is guided in a moving fashion on the piston extension 34, advantageously rests against an adjusting spring 38. The dimensioning of the adjusting spring 38 makes it possible to assure the effectiveness of the high-pressure-tight connection 33 at the lower end of the first housing part 8 over the entire stroke path of the pressure booster piston 14 inside the second housing part 9 of the injector body 4. The routing of the central control line 31 essentially coaxial to the symmetry line of the injector body 4 eliminates the need for providing an additional high-

pressure line to the on-off valve 5 on the outside of the injector body 4, which line would be required for controlling the differential pressure chamber 17 of the pressure booster 11. A pressure booster 11 that is triggered via the differential pressure chamber 17 (also referred to as the return chamber) is particularly advantageous in terms of its discharge losses. With the design proposed according to the invention, it is possible for a pressure booster 11 that is controlled via its differential pressure chamber 17 to be disposed coaxial to the injector housing 10 of the fuel injection device 1 without negatively influencing the outer dimensions of the injector body 4. As a result, it is also possible to avoid placing the pressure booster 11 eccentrically in relation to the injection valve element 24 disposed in the symmetry axis of the fuel injection device 1, which would be disadvantageous with regard to production complexity and costs.

Page 14, please replace paragraph [0035] with the following amended paragraph:

[0035] In addition, a line section extends from the high-pressure chamber 19 to the **nozzle control** chamber 20. This line section contains an inlet throttle 21. The control chamber 20 for the injection valve element 24 contains a nozzle spring 27, which rests against an annular surface of the injection valve element 24 at one end, encompassing a pin 28. At the other end, the nozzle spring 27 rests against a wall of the second housing part 9 delimiting the **nozzle control** chamber 20. An overflow of control volume from the **nozzle control** chamber 20 into the differential pressure chamber 17 of the pressure booster 11 occurs via the discharge line 29 that contains an outlet throttle 30 and connects the **nozzle control** chamber 20 to the differential pressure chamber 17.

Page 20, please replace paragraph [0047] with the following amended paragraph:

[0047] When the lower end of the pressure booster piston 14 travels into the high-pressure chamber 19, this increases the pressure of the fuel contained therein in accordance with the pressure boosting ratio of the pressure booster 11. The fuel flows from the high-pressure chamber 19 to the nozzle chamber 23 via the nozzle chamber inlet 22. In the region of the nozzle chamber 23, the injection valve element 24, which can be embodied for example as a nozzle needle, has a pressure shoulder that causes the injection valve element 24 to move vertically in the opening direction, i.e. into the control chamber 20, in response to the highly pressurized fuel flowing into the nozzle chamber 23. The fuel contained in the nozzle chamber 23 flows through the annular gap encompassing the injection valve element 24, to injection openings 25 and from there, is injected into the combustion chamber 26 of the autoignition internal combustion engine. The fuel volume displaced when the nozzle of the injection valve element 24 travels upward in the ~~nozzle~~ control chamber 20 flows through the discharge line 29 and the throttle restriction 30 contained therein, and to the pressure-relieved differential pressure chamber 17. From there, the displaced control volume flows through the lateral opening 41, the chamber 63, the central control line 31 inside the piston part 60, and the overflow line 43 to the on-off valve 5 and from there, into the low-pressure side return 7.

Page 23, please replace paragraph [0053] with the following amended paragraph:

[0053] The pressure booster piston 14 seals the working chamber 12 of the pressure booster 11 off from the differential pressure chamber 17 integrated into the injector body 4. The return spring 18 is contained in the working chamber 12 of the pressure booster 11. This return spring 18, encompassing a sleeve-shaped region of the pressure booster piston 14, rests

against the first washer 51 and the second washer 52. The first washer 51 is attached to the upper end of the pressure booster piston 14, while the second washer ~~52~~ ~~50~~ can be inserted into the wall of the injector body 4. The second washer 52 is disposed above the first end 15 of the pressure booster piston while the second end 16 of the pressure booster piston 14 constitutes a delimiting surface of the differential pressure chamber 17 of the pressure booster 11.

Please replace paragraph [0054] with the following amended paragraph:

[0054] In the exemplary embodiment of the fuel injection device 1 shown in Fig. 4, the control chamber 20 of an injection valve element 80 is integrated into the pressure booster piston 14. The nozzle spring 27 that acts on an end 79 of the injection valve element 80 is contained inside the control pressure chamber 20. The injection valve element 80 according to the exemplary embodiment in Fig. 4 is encompassed by the high-pressure chamber 19 of the pressure booster 11, i.e. in this exemplary embodiment, the high-pressure chamber 19 and the nozzle chamber 23 are identical. According to the exemplary embodiment in Fig. 4, the nozzle chamber 23 is constituted by the high-pressure chamber 19 of the pressure booster 11. **Below** In the high-pressure chamber 19 of the pressure booster piston 14, the injection valve element 80 is encompassed by a sealing sleeve 81. A spring element 82, which is contained in the high-pressure chamber 19 of the pressure booster 11, acts on the sealing sleeve 81 and presses it tightly against the end of piston 14 oriented toward the high-pressure chamber 19 of the pressure booster 11 so that the control chamber 20 and a coaxial piston 74 that travels into it are sealed off from the high-pressure chamber 19. The injection valve element 80 has a fuel conduit 83 that passes through the injection valve 80 at an inclined angle, which feeds into an annular gap 84 between the injection valve element 80 and the injector body 4 at the end of the fuel injection device 1 oriented toward the combustion chamber. Below the

annular chamber 84 in the injector body 4, the seat at the combustion chamber end of the injection valve element 80 is closed.

Page 24, please replace paragraph [0055] with the following amended paragraph:

[0055] According to the exemplary embodiment in Fig. 4, the pressure booster piston 14 has a coaxial piston 74 integrated into it, which is disposed symmetrical to the symmetry axis of the injector body 4 of the fuel injection device 1 and is contained in a stationary fashion inside the injector body 4. The pressure booster piston 14 can be moved in relation to this coaxial piston. The conduit 40 that serves as the central control line 31 for exerting pressure on or relieving pressure in the differential pressure chamber 17 passes through the coaxial piston 74. Inside the sleeve-shaped region of the pressure booster piston 14, the coaxial piston 74 has a support surface 75. A prestressed spring 76 rests against the support surface 75 and presses the sealing sleeve 36 tightly against the injector body 4. This makes it possible to compensate for manufacturing tolerances in multi-part injector housings. This makes it possible to compensate for manufacturing tolerances in multi-part injector housings.

In this manner, the central control line 31 is sealed off from the high pressure prevailing in the high-pressure reservoir 2 that is also present in the working chamber 12 via the high-pressure line 3. At the end of the coaxial piston 74 oriented away from the sealing sleeve 36, the coaxial piston is encompassed by the nozzle spring 27 contained in the control chamber 20. The lateral opening 41 passes through the coaxial piston 74 in the region of the control chamber 20. Between the differential pressure chamber 17 and the control chamber 20, there is a first connection via a first outlet cross section 77 and a second connection constituted by the second outlet cross section 78. In comparison to the second outlet cross section 78, the first outlet cross section 77 has a smaller flow cross section and is always effective, whereas

the second outlet cross section 78 is opened or closed in accordance with the stroke path of the pressure booster piston 14 of the pressure booster 11.

Page 25, please replace paragraph [0056] with the following amended paragraph:

[0056] In the switched position of the servo-hydraulic 3/2-way valve 70 shown in Fig. 4, the valve is closed. The pressure level prevailing in the high-pressure chamber 2 prevails in the working chamber 12 of the pressure booster 11 via the high-pressure line 3 extending from the high-pressure reservoir 2 into the working chamber 12. The differential pressure chamber 17 of the pressure booster 11 is acted on with fuel pressure via the open control edge VQ1 (valve cross section) and the central control line 31 in accordance with the pressure level prevailing in the working chamber 12. The control chamber 20 is likewise acted on with the pressure level prevailing in the high-pressure reservoir via the first outlet cross section 77. This pressure level is also present at the servo-hydraulic 3/2-way valve 70 via the lateral opening 41 and the conduit 40 that serves as the central control line 31.

Page 28, please add the following new paragraph after paragraph [0059]:

[0060] The foregoing relates to preferred exemplary embodiments of the invention, it being understood that other variants and embodiments thereof are possible within the spirit and scope of the invention, the latter being defined by the appended claims.

Please cancel pages 29-31.